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Record of Decision:

NAVAL SURFACE WARFARE CENTER - DAHLGREN
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SITE 9 DISPOSAL/BURN AREA

NAVAL SURFACE WARFARE CENTER
DAHLGREN SITE
DAHLGREN, VIRGINIA
RECORD OF DECISION

SEPTEMBER 1998

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1.1 SITE NAME AND LOCATION

Site 9 Disposal/Burn Area
Naval Surface Warfare Center
Dahlgren, Virginia

1.2 STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for Site 9 Disposal/Burn Area and Site 58 Building 1350 Landfill (SWMU 134) at the Naval Surface Warfare Center, Dahlgren Site (NSWCDL) Dahlgren, Virginia. Site 58 is a physical extension of the Site 9 Landfill and will be remediated pursurant to this Record of Decision, Herein, Site 58 is addressed when Site 9 is referenced. This document focuses on remedial decisions for Site 9 at the NSWCDL and the term "site" in this document refers to Site 9. This determination has been made in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for this site.

The Commonwealth of Virginia concurs with the selected remedy (see Appendix A).

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

1.3 DESCRIPTION OF THE SELECTED REMEDY

The Navy will manage the remediation of the Disposal/Burn Area as a single remedial action. The remedial action selected in this ROD addresses contamination associated with Site 9 Disposal/Burn Area contents, surface soils, subsurface soils, marsh sediments, and groundwater. Possible contaminated surface water and sediments in Gambo Creek near Site 9 will undergo further evaluation as part of the Gambo Creek Ecological Assessment and a separate ROD will be issued for Gambo Creek. Any remedial action selected in the future for Gambo Creek will be consistent with this ROD.

The selected remedy for Site 9 is to utilize capping to address both soils and sediments, and to provide institutional controls, as well as groundwater, surface water, and sediment monitoring.

The major components of the selected remedy are:

Landfill

Wastes in the southern area, estimated at approximately 250 cubic yards (cy), shall be excavated until bare soil is exposed. These wastes and surface soils shall be consolidated and stabilized on the landfill portion of the site. Consolidation may include size separation, crushing and grinding, and dewatering. The landfill, estimated to be approximately 5.0 acres upon completion of closure activities, will be covered with a multilayer cap meeting the requirements of the Virginia Solid Waste Management Regulations, 9 VAC 20-80-210 (Remedial Requirements) and 9 VAC 20-80-250 (sanitary landfill).

The landfill cap will substantially limit precipitation and runoff from entering the consolidated fill material. Based on preliminary modeling conducted to date by the Navy, it is anticipated that the multilayer cap will need to exceed the minimum requirements of a 9 VAC 20-80-250 (sanitary landfill) to be protective of receptors in Gambo Creek, The final cap components will be determined during the final design for Site 9. The multilayer cap will be revegetated, and the closure completed consistent with 9 VAC 20-80-250 (sanitary landfill) closure requirements. The closure will include provisions for the installation of structures at the toe of the landfill and elsewhere to provide erosion and sediment control measures, including protection from surges in the water surface of Gambo Creek due to major regional storm events such as hurricanes. The current boundary of the landfill will be pulled back from Gambo Creek so that the waste associated with the cap will be a minimum of 100 feet from Gambo Creek.

An impermeable slurry wall will be installed on the hydraulically upgradient (west) side of the landfill, which shall effectively redirect groundwater movement around the capped landfill. The slurry wall will be installed to a depth below grade and key into the clay confining unit beneath the site.

Marsh

Surface debris will be removed (excavated) from the marshy area of the site and consolidated and stabilized on the landfill. It is estimated that approximately 260 cy of surface debris will be removed from the marsh. Vegetation in the marshy area of the site will be out back. If necessary, to support construction in the marsh, a geogrid layer will be anchored over the entire 2.4 acre area. The placement of the geogrid over the marsh would improve the lateral stability of the soils in the area and allow construction equipment to complete the placement of the cap over the waste disposal areas in the marsh. The marsh cap will meet the Virginia Sanitary landfill cap minimum thickness requirement of 2 feet The marsh cap would provide sound engineering controls per 9 VAC 20-80-250 to help control groundwater which intrudes the site by being constructed to an elevation (estimated to be 4 feet mean sea level (mnsl) which will preclude the possibility of groundwater migrating upward through the waste and reaching, the cap surface. The marsh cap will address 9 VAC 20-80-250 requirements to control releases or otherwise reduce site risks by: 1) cutting off potential contact exposure to wastes in the marsh; 2) enhancing evaporation of contaminated groundwater which flows within the marsh cap; and 3) providing additional sorbing to soils through which the contaminated groundwater must pass before being discharged to the marsh. Upon completion of the placement of the marsh cap, appropriate vegetation will be re-introduced and maintained. Installation of the marsh cap will raise the elevation of the marsh and will likely turn the capped area into an upland environment. The wetland loss will be mitigated elsewhere at the NSWCDL facility.

Where Gambo Creek is within 100 feet of the waste/fill material in the marsh, on the northeastern portion of the site, the shoreline of Gambo Creek will be protected against erosion to provide a benefit equivalent to moving waste 100 feet away from Gambo, Creek. This action shall address Commonwealth of Virginia regulation 9 VAC 20-80-250. It is conservatively assumed that the shoreline protection will consist of spot regrading of the Gambo Creek stream bank, placement of a geotextile, layer, and placement of riprap to the same elevation as the existing stream bank. It is anticipated that 560 linear feet of shoreline protection will be required. Portions of Gambo Creek on the southeastern portion of the site will be filled, and established as wetlands.

While groundwater, surface water, and sediments shall be addressed through the above source controls, other steps will also be taken to minimize risks. Institutional controls, including limiting site access through gates and limiting future land use, will be implemented to eliminate or reduce pathways of exposure to contaminants at the site. Monitoring will also be instituted to determine if contaminants are migrating at significant rates and concentrations.

Institutional controls will be implemented to limit future site land use. For Site 9, an institutional control plan will be developed as a part of remedial action design and include: access controls, signs along the perimeter of the site, restrictions on shallow groundwater use for drinking water, description of land use controls in the base master plan, periodic inspection, monitoring, and re-evaluation of land use controls, annual certification that institutional controls are in place, notification to the U.S. EPA and state regulators whenever the Navy anticipates any major changes in land use restrictions, public notice, and a deed notification.

The Navy shall institute the following institutional controls within 90 days of installation of the capping system: a real property description notation, Base Master Plan notations, and limited site access. The Base Master Plan shall note the area as one in which residential development cannot occur, shallow groundwater cannot be used, and site access shall be limited. A notation shall be filed in the real property file maintained at Engineering Field Activity, Chesapeake (EFA Ches) (US Navy) for this site indicating the extent of the area and the fact that solid wastes are present. The institutional controls shall also include the following: within 90 days after completion of the remedy, the Navy shall produce a survey plat prepared by a professional land surveyor registered by the Commonwealth of Virginia, indicating the location and dimensions of the disposal area and the extent of groundwater contamination. Monitoring well locations shall be included and identified on the survey plat. The plat shall contain a note, prominently displayed, which states the owner's future obligation to restrict disturbance (excavation or construction) of the property. In addition, post-closure use of the property shall prohibit residential use and access or use of groundwater underlying the property for any purpose except monitoring and the function of the monitoring systems shall not be disturbed. When landfill closure is complete, the owner of the property shall submit the survey plat to the local recording authority, and shall record a notation with the deed (or some other instrument which is normally examined during title search at the local land recording authority) notifying any potential

purchaser of the property that the land has been used to manage solid waste and the integrity of the cover system or the function of the monitoring system may not be disturbed.

The Navy shall institute groundwater monitoring to ensure remedial action objectives are being maintained. The frequency of analysis and the length of time for monitoring shall be developed in the Operation and Maintenance Plan. The Navy shall also monitor the surface waters and sediments at Site 9. The frequency of analysis and the length of time for monitoring shall be specified in the Operation and Maintenance Plan.

Implementation of the selected remedy will address the principal threats at the site by reducing the potential risk to human health and the environment associated with the surface soils, subsurface soils, sediment, and groundwater.

1.4 STATUTORY DETERMINATIONS

The selected remedy for Site 9 is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to this action, and is cost-effective.

The selected remedy for Site 9 addresses the remediation of surface soils, subsurface soils, sediment, and groundwater contamination at Site 9. The selected remedy will provide for the long-term containment of contamination in these media beneath the site. The installation of a capping system will reduce direct contact and ingestion threats, and reduce risks to ecological receptors from contaminated media by containing contaminants from these media.

The selected remedy for Site 9 will be constructed to meet all applicable or relevant and appropriate requirements (ARARs) whether chemical-, action-, or location-specific. No waivers of any ARARs are requested. Capping is a permanent solution and is an appropriate remedy for the contamination at the site. Capping is standard technology and its application at Site 9 is considered technically superior to other alternatives.

This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable for this operable unit. However, because treatment of the principal threats of the site was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element.

Because this remedy will result in hazardous substances remaining on-site above health-based levels, a review will be conducted within five years after commencement of the remedial action to ensure that the remedy provides adequate protection of human health and the environment.

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2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

This ROD is issued to describe the Department of the Navy's (NAVY) selected remedial action for Site 9, Disposal/Burn Area, at the NSWCDL, Dahlgren, Virginia (Figure 2-1). Site 9 is one of several Installation Restoration (IR) sites (Figure 2-2) located at the NSWCDL facility.

The Disposal/Burn Area is an inactive landfill, approximately 5 acres in size, located off Caskey Road in the central portion of the Mainside, adjacent to the southwestern shore of Gambo Creek and associated marsh area. Gambo Creek and its associated marsh area border approximately two-thirds of the site to the east and north (Figure 2-3). The majority of the remaining area surrounding Site 9 is wooded. A fenced magazine (Building 954) is located approximately 80 feet west of the northwestern boundary of Site 9. An active dog kennel (Building 1312) is located approximately 100 feet south of the site. A paved road provides access to a gated entrance from the southwest. Historic information indicates that the facility used this area as a sanitary landfill from the early 1940s until 1971. However, dumping and occasional burial of construction debris and tree stumps continued until 1984.

During the Remedial Investigation (RI), a magnetic field survey was conducted to delineate the extent of the landfill (Figure 24). The landfill fans out north and east toward Gambo Creek and the marsh. One to two feet of soil covers the top of the landfill, although debris is visible along the slopes leading to Gambo Creek and the marsh. The exact depth of the fill is between 5 and 15 feet in the landfill and in the marsh respectively, based on test pit excavations. The site lies on a nearly level parcel of land, with elevations

across the site ranging from over 10 feet above mean sea-level (msl) in the center of the landfill to approximately 2 feet above msl at the base of the landfill slope in the marsh area. It is assumed that landfilling operations at Site 9 have altered the original topography. There are currently no structures on the site. The majority of the site is vegetated and several features are visible on the land surFace. Obvious features include a large pile of fill soil in the northeast comer, several slabs of steel-reinforced concrete adjacent to the pile of soil, and a pile of cut trees in the center of the site. Surface drainage predominately flows in a southerly or southeasterly direction toward the large marsh area adjacent to Gambo Creek. An east-west drainage ditch runs along the southern portion of the landfill surface and through a culvert prior to entering Gambo Creek. Gambo Creek flows south-southeast and empties into Upper Machodoc Creek.

Site 58, also called the Building 1350 Landfill (Solid Waste Management Unit (SWMU) 134), is an extension of Site 9 to the southeast and will be remediated with Site 9. This site, approximately 0.7 acre in size, is adjacent to Kennel Road. and extends to Gambo Creek. This landfill was in use during a later period than Site 9. The following items were observed at Site 58: 55-gallon drums of roofing tar, 5-gallon and 1-gallon empty paint cans, railroad ties, fires, roofing shingles, and miscellaneous steel and concrete debris. The area has a moderate to heavy vegetative cover. Surface water flows directly into Gambo Creek, or into a drainage ditch on the south end of the site, and subsequently into Gambo Creek.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.2.1 History of Site Activities

The history of Site 9 has been developed primarily from an Environmental Photographic Interpretation Center (EPIC) analysis of aerial photographs prepared by U.S. EPA in 1992. A summary of the site history is discussed in the following paragraphs.

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Documentation of activity at Site 9 began in 1937. Evidence of waste disposal in the northern and eastern portions of the site and along the edge of the marsh adjacent to the creek was observed in the 1943 imagery. Continued site expansion and ongoing disposal activity was noted through the 1990 imagery. Evidence of liquid discharges emanating from the material lining the perimeter of the fill area and flowing south, and emanating from the center of the fill area and flowing north, was observed in the 1953 and 1958 imagery, respectively.

By 1960, filling operations had expanded across the marsh into Gambo Creek, and runoff had stained the surface of the fill area as it flowed toward both the creek and a western channelized drainage path. Two small trenches and a new fill area were observed west of the drainage path. A wide trench, spanning the length of the new fill area and leading to the channelized drainage path was observed in the 1962 imagery. Evidence of liquid discharge, flowing from the original fill area to Gambo Creek, was observed in the 1967 imagery, and filling operations had narrowed the width of the main channel. By 1969, filling operations had completely altered the course of Gambo Creek. This change was apparently the result of a large increase in the amount of material disposed on the east side of the new fill area. A smoke plume from a nearby classified paper incinerator was also visible east of the new fill area in the 1969 imagery, and two horizontal storage tanks (containing roofing tar) were observed in the southern portion of the site.

The 1974 imagery showed that the (original) fill area, which extended north into the marsh, was revegetating while dumping continued in the southern portion of the site. By 1981 enough fill material had been added to the north and east sections of the southern fill area to extend over most of the original fill area. Large quantities of debris were observed along the fill face and in the center of the site in the 1983 and 1985 imagery. The 1990 imagery indicated most of the fill areas were revegetating. Drainage continued to flow east from the northern portion of the site, into Gambo Creek. Evidence of crates and containers was noted to the north, and a large area of debris was evident in the center of the landfill.

2.2.2 Previous Investigations

The first investigation at Site 9 was the Initial Assessment Study (IAS) in 1981. The IAS, involved an on-site records review, site visit, and personnel interviews. The IAS determined that given the unknown nature and extent of the waste disposed at Site 9, and the direct hydraulic connection of the site to Gambo Creek and adjacent marsh areas, a Confirmation Study should be performed to determine the types and

quantities of matadals escaping from the landfill, as well as the potential for impacts on the surrounding marsh environment and Gambo Creek.

Additionally, the IAS indicated that friable asbestos insulation was disposed along with ordinary refuse, and waste ash from heating coal used by NSWCDL until the mid-1940s was most likely disposed at the Disposal/Burn Area. Subsequent Investigations did not find asbestos in the landfill, and based upon available information it is anticipated that asbestos would onsite less than one percent of the waste mass at Site 9. Therefore, Site 9 is not subject to closure requirernents applicable to asbestos-containing materials. NSWCDL converted from coal to oil in the mid-1940s. Historical records indicate that oil and grease from traps connected with vehicle washing operations at Building 1329 were hauled to Site 9 for disposal.

The Confirmation Study at Site 9 was conducted in 1983 and 1984. As part of the study, four groundwater monitoring wells were installed (upgradient well GW9-1 and downgradient wells GW9-2, GW9-3, and GW-94) to monitor groundwater quality in the shallow aquifer. These wells were sampled in November 1983, December 1983, and November 1984. Four leachate samples were also collected from the standing water at the base of the landfill face. Groundwater and leachate samples were analyzed for the following: total organic carbon (TOC), total organic halides (TOX), phenol, iron, manganese, sodium, chloride, and sulfate.

Based on the field investigation and analytical results of the Confirmation Study at Site 9, R was concluded that the elevated phenol concentrations (0.07 mg/kg) deteded in the groundwater of the Disposal/Burn Area did not meet Virginia groundwater quality standards, and that TOC (5,100 mg/L) and TOX (280 Ig/L) concentrations were elevated above typical background levels. Recommendations included the implementation of a comprehensive groundwater monitoring program.

2.2.3 Enforcement Actions

No enforcement actions have been taken at Site 9. The Navy has owned this property since the early 1900's and is identified as the responsible party.

2.2.4 Highlight of Community Participation

In accordance with Section 113 and 117 of CERCLA, the Navy provided a public comment period from August 20, 1998 through September 18, 1998 for the proposed remedial action described in the Feasibility Study and the Proposed Plan for Site 9.

These documents were available to the public in the Administrative Record and information repositories maintained at the Smoot Memorial Library, King George, Virginia; the NSWCDL General Library, Dahlgren, Virginia; and the NSWCDL Public Record Room, Dahlgren, Virginia. Public notice was provided in The Freelance Star newspaper on August 20, 1998 and The Journal newspaper on August 19, 1998 and a public meeting was held in the King George Courthouse on August 27, 1998. No written comments were received during the comment period, and the comments and responses provided during the public meeting are presented in Appendix B.

2.3 SCOPE AND ROLE OF RESPONSE ACTION SITE 9

Past disposal operations at the site have contaminated soil, groundwater, and sediments. The Navy has decided to manage the remediation of the site as a single unit. The remedial actions identified in this ROD address contamination associated with Site 9, Disposal/Burn Area, as identified in the Draft Final RI Report, the Addendum RI Report, the Feasibility Study (FS) Report, and the Addendum FS Report for Site 9. Several alternatives for response actions for contaminated media are identified in Section 2.6. The rationale for selecting one of those alternatives as the remedy for this site is described in Section 2.7.

The selected remedy is to cap landfill soils and marsh sediments. Contaminated surface and subsurface soils at Site 58 would be excavated and consolidated beneath the landfill cap, and shoreline protection will be utilized to achieve 100 toot setback requirements established by the Commonwealth of Virginia. The selected remedy will reduce the potential risk to ecological receptors associated with pesticides and metals present in surface soils, metals present in subsurface soils and groundwater migrating to Gambo Creek, and metals, pesticides/polychlorinated b1phenyls (PCBs), and semivolatile compounds (SVOCs) present in surface sediments in the marsh. The selected remedy will reduce the potential risk to human receptors from metals in groundwater migrating to Gambo Creek.

This ROD is consistent with long-term remedial goals for Site 9. The selected remedy will reduce the principal threat to ecological receptors in Gambo Creek from soil, groundwater, and sediment contamination.

2.4 SUMMARY OF SITE CHARACTERISTICS

The RI at Site 9 was completed in phases. Geophysical investigations were initiated in 1993. Sampling activities, consisting of soil sampling, surface water and sediment sampling, and the installation and sampling of groundwater monitoring wells, were completed in 1994. Additional RI sampling, consisting of additional surface and subsurface soil sampling and groundwater monitoring activities was completed in 1996. The results of the RI are summarized below.

2.4.1 Sources of Contamination

Geophysical and hydrogeologic investigations at Site 9 were conducted to identify disturbed areas and buried metallic objects, and to investigate the extent of the landfill. The results of the survey indicated the presence of metallic objects. These investigations along with test pits verified the extent of the landfill. In addition, test pits verified the extent of buried wastes present in the marsh adjacent to the landfill. Based on groundwater, subsurface soil, and sediment sampling results, the sources of contamination are the wastes present in the landfill and marsh.

2.4.2 Description of Contamination

Soil, groundwater, surface water, and sediment samples were collected and analyzed to determine the nature and extent of contamination at Site 9 (Figure 2-5). The contamination concerns at Site 9 are associated with the landfill. Surface soil, subsurface soil, groundwater, surface water, and sediments have been impacted by the waste disposal activities that occurred there. The primary contaminants of concern (COC) are SVOCs (polynuclear aromatic hydrocarbons [PAH] compounds), pesticides, and various metals (Table 2-1). The results of the sampling and analyse are presented below,

Surface and Subsurface Soils

Low-level (PAH) contamination (0.026 to 0.12 mg/kg) and pesticides (0.0038 to 0.72 mg/kg) were identified in surface soils. Elevated levels of several metals, including arsenic (5.3 mg/kg), copper (2,250 mg/kg), lead (128 mg/kg), mercury (0.93 mg/kg), and zinc (473 mg/kg) were also detected. In the subsurface soils, high-level PAH contamination (21 to 150 mg/kg) and inorganic contamination were identified, with lead (3,250 mg/kg) detected at the highest concentration. Low-level pesticides (0.0012 to 2.7 mg/kg) were also detected in the subsurface soils, The PAH and inorganic contamination appear to be related to the landfill itself whereas the pesticide contamination appears to be related to wide spread spraying across the base.

Groundwater

Low-level PAH (0.5 to 53 Ig/L) and pesticide (0.0129 to 0.2 Ig/L) contamination was identified in groundwater. Low level SVOC contamination (0.6 to 3 Ig/L) was also detected from seep samples. Inorganic contaminants, such as barium (3,950 Ig/L), lead (1,370 Ig/L), and zinc (2,940 Ig/L) were detected at high levels in groundwater. Inorganic contaminants in seepage were detected at only low to moderate levels with respect to background.

Surface Water and Sediment

No significant volatile organic compound (VOC), SVOC, or pesticide/PCB contamination was identified in surface water samples collected from Site 9. Inorganics; detected were at levels similar to or below background in the majority of surface water samples. Two surface water sample locations, however, exhibited elevated concentrations of inorganics, including lead (252 Ig/L) and mercury (I lag/Q. Sediment sample results indicate low level VOC contamination (0.005 mg/kg to 0.58 mg/kg) and SVOC contamination (0.025 mg/kg to 1.0 mg/kg). Pesticides were detected at moderately elevated concentrations (0.0034 to 9.1 mg/kg). Inorganic concentrations for most constituents in sediment were within or only slightly elevated above background levels. Copper (5,390 mg/kg) and lead (743 mg/kg) were well above background levels.

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TABLE 2-1

MAXIMUM DETECTED VALUES FOR COCs IN ALL MEDIA
SITE 9: DISPOSAL/BURN AREA
NAVAL SURFACE WARFARE CENTER, DAHLGREN, VIRGINIA

Chemical of Concern	Maximum Detected Value
SURFACE SOILS	
Organics (mg/kg)	
Benzo(a)anthracene	0.08
Benzo(a)pyrene	0.081
Benzo(b)flouranthene	0.12
Benzo(k)flouranthene	0.15
Indeno(1,2,3-cd)pyrene	0.056
Phenols	0.006
4,4'-DDE	0.420
4,4'-DDT	0.720
Inorganics (mg/kg)	
Aluminum	9,150
Arsenic	5.3
Chromium	16.5
Copper	2,250
Lead	128
Iron	16,700
Mercury	0.93
Vanadium	29.8
Zinc	473
SUBSURFACE SOILS	
Organics (mg/kg)	
Benzo(a)anthracene	150
Benzo(a)pyrene	110
Benzo(b)fluoranthene	54
Benzo(k)flouranthene	140
Dibenzo(a,h)anthracene	21
lndeno(1,2,3-cd)pyrene	44
Inorganics (mg/g)	
Arsenic	13.6
Lead	3,250
Iron	186,000
SEDIMENTS	
Organics (mg/kg)	
Acetone	0.58

TABLE 2-1
MAXIMUM DETECTED VALUES FOR COCs IN ALL MEDIA
SITE 9: DISPOSAL/BURN AREA
NAVAL SURFACE WARFARE CENTER, DAHLGREN, VIRGINIA

Chemical of Concern	Maximum Detected Value
Alpha chlordane	0.022
Carbon Disulfide	0.007
4,4'-DDD	9.1
Gamma chlordane	0.012
Kelthane	0.031
Inorganics (mg/kg)	
Aluminum	24,100
Arsenic	17.1
Beryllium	1.5
Cadmium	6.2
Chromium	43.6
Copper	5,390
Iron	36,300
Lead	743
Mercury	1.2
Silver	32.3
Vanadium	55
Zinc	1,600
SURFACE WATER	
Organics (Ig/L)	
Carbon Disulfide	4.0
Heptachlor	0.094
Flouranthene	0.5
Inorganics (Ig/L)	
Aluminum	15,200
Arsenic	16
Beryllium	1.5
Cadmium	2
Chromium	23.2
Copper	124
Cobalt	20.4
Iron	46,300
Lead	252
Manganese	1,910
Mercury	1
Nickel	33.9
Silver	4.1
Zinc	368

TABLE 2-1
MAXIMUM DETECTED VALUES FOR COCs IN ALL MEDIA
SITE 9: DISPOSAL/BURN AREA
NAVAL SURFACE WARFARE CENTER, DAHLGREN, VIRGINIA

Chemical of Concern	Maximum Detected Value GROUNDWATER(1)
Organics (Ig/L)	
Heptachlor	0.105
Phenanthrene	44
Inorganics (Ig/L)	
Arsenic	13.2
Barium	3,950
Copper	583
Cyanide	4.3
Lead	1,370
Manganese	1,350
Nickel	62.7
Zinc	2,940

1 Groundwater COCs were developed based on the expected industrial use scenario

2.4.3 Contaminant Migration

The presence of both organic and inorganic contaminants in the groundwater and seeps, as well as in surface water and sediment samples, indicates the likelihood that migration has occurred into the surrounding environmental media at this site. The major contaminants noted in the surface water and sediment samples were PAH compounds, pesticides, and metals. Volatile organics were not determined to be prevalent.

Given the distribution of compounds in groundwater, surface water, and sediment samples, two primary release mechanisms can be identified. The first is migration as a solute from the buried waste in the landfill and marsh, and the second is the migration via overland runoff/surface water flow.

Of the organic chemicals detected in groundwater monitoring wells at Site 9, only the volatile organic compounds benzene, ethylbenzene, and xylenes, which were detected at low concentrations, are relatively highly soluble. Because of these high solubilities, these compounds are susceptible to transport via dissolution by infiltrating precipitation or fluctuations in the watertable.

The PAH compounds, detected primarily in only one well, are not as likely to be transported in a soluble phase, given their relatively lower solubilities and vapor pressures. The lower molecular weight PAHs (e.g., acenaphthene, anthracene, fluorene, phenanthrene) may volatilize from surface waters, while the higher molecular weight PAHs (e.g., benzo[alpyrene, benzo[a]anthracene, chrysene) are less likely to volatilize. PAHs in water are much more likely to bind to soil and be transported via mass transport mechanisms.

The source of elevated metals at Site 9 is most likely due to the disposal of metallic waste in both the landfill area and the marsh adjacent to the landfill. The release of relatively insoluble contaminants via groundwater transport and overland transport is also a significant release mechanism acting at this site. When the landfill was in operation, bare soil and surface-deposited wastes would have been subject to erosion during precipitation. Soil containing contaminants would have been transported downslope via rainwater flow toward Gambo Creek or the marsh, where flow would slow and sediments would be deposited. This material, along with the buried waste in the landfill and marsh acts as a secondary source of contamination, evidenced by the presence of insoluble contaminants in unfiltered water samples collected from these areas. Samples collected from areas farther from the primary source contained much lower concentrations of these contaminants.

Metals are highly persistent environmental contaminants. The major fate mechanisms for metals are adsorption to the soil matrix (as opposed to being part of the soil structure) and bioaccumulation. The average groundwater pH at Site 9 is between 6 and 7, indicating that metals are only somewhat mobile in the dissolved phase.

2.5 SUMMARY OF SITE RISKS

The human health and ecological risks associated with exposure to contaminated media at Site 9 were evaluated in the Addendum RI Report for Site 9. The residential use scenario was not evaluated because the site will remain in industrial use. Insttutional controls will be implemented to prohibit residential use and shallow groundwater use. Off-site migration of impacted groundwater is not anUcipated to be a human health concern since the discharge location (Gambo Creek) is located immediately adjacent to Site 9. Groundwater in the shallow aquifer is not a current source of drinking water and will not be used as one in the future. Exposure to surface water is expected to be limited to fishermen in boats.

2.5.1 Human Health Risks

Exposure Pathways and Potential Receptors

Base workers, recreational users (adults and children), and construction workers were evaluated as potential receptors in the quantitative risk assessment. Construction workers were evaluated for future conditions only. The remaining receptors are considered for current and future conditions. Ingestion of fin fish was evaluated for adult recreational users only. Construction workers were evaluated for exposure to surface subsurface soil (0 to 12 feet), while surface soil (0 to 2 feet) exposure was considered for all other receptors. Inhalation of volatile emissions and fugitive dust was evaluated qualitatively via a comparison of site data to U.S. EPA Generic Soil Screening levels for transfers from soil to air. Inhalation exposure was considered to be relatively insignificant since all detected soil concentrations were less than the screening levels. Direct contact with surface water and sediment is expected to be intermittent and of short duration because swimming in Gambo Creek is unlikely due to inhospitable conditions and access limitations. Therefore, pathways associated with these media were not quantitatively evaluated.

Exposure Assessment

The COCs that were evaluated and their maximum exposure point concentrations are presented in Table 2-2. Exposure point concentrations are used to determine potential human health risks.

Toxicity Assessment

Cancer potency factors (CPFs) have been developed by U.S. EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals., CPFs, which are unitless, are multiplied by the estimated intake of a potential carcinogen, in mg/kg/day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term upper bound reflects the conservative estimate of the risks calculated from the CPFs. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Reference doses (RfDs) have been developed by U.S. EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimate intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

Risk Characterization

Excess lifetime cancer risks are determined by multiplying the intake level with the cancer potency factor. These risks are probabilities that are generally expressed in scientific notation (e.g., 1x10 -6). An excess lifetime cancer risk of 1 x 10 -6 indicates that as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime, under the specific exposure conditions at a site.

TABLE 2-2
HUMAN HEALTH
CHEMICALS OF CONCERN AND EXPOSURE POINT CONCENTRATIONS(1)
SITE 9: DISPOSAL/BURN AREA
NSWCDL, DAHLGREN, VIRGINIA

Medium	Organics		Inorganics	
	Chemical	Exposure Point Concentration (mg/kg)	Chemical	Exposure Point Concentration (mg/kg)
Surface Soil	No COCs (2)	NA	Arsenic	3.2/5.3(3)
Surface/ Subsurface Soil	Benzo(a)anthracene	10	Arsenic	6.5
	Benzo(a)pyrene	7.61	Iron	20000
	Benzo(b)fluoranthene	4.2	Lead	184
	Benzo(k)fluoranthene	6.4		
	Dibenz(a,h)anthracene	1.4		
	Indeno(1,2,3-cd)pyrene	3.8		
Fish Tissue(4)	Fluoranthene	6.0(5)	Aluminum	152(5)
	Heptachlor	0.8977(5)	Arsenic	0.2728
			Beryllium	0.01387
			Cadmium	0.1134
			Cobalt	10.66
			Iron	463(5)
			Mercury	2.024
			Silver	6.468
			Manganese	4,393
Surface Water/Sediment	Not evaluated(6)	NA	Not evaluated	NA

1 95 percent upper confidence limits (UCLs) were used as exposure point concentrations for reasonable maximum exposure (RME) and central tendency effect (CTE), unless otherwise noted.
2 All detected concentrations are less than U.S. EPA Region III risk-based concentrations (RBCs).
3 Data set consists of <10 samples. Average and maximum concentrations were used for the CTE and RME.
4 Theoretical concentrations are based upon maximum surface water concentrations and chemical-specific bio-concentrations factors (BCFs).
5 Maximum detection was used since the calculated 95 percent UCL exceeds the maximum.
6 No human exposure is anticipated because of site-specific conditions (i.e., inaccessibility, the presence of snake and snapping turtles, etc.)

NA Not applicable.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminants reference dose). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media.

Current Bass Worker. The cumulative noricancer hazard indices for ingestion of and dermal contact with soils for Site 9, under industrial land use conditions are less than 1, which indicates that there are no significant hazards associated with soils at Site 9. The cumulative ingestion and dermal contact cancer risk is 7.4 x 10 -4, under a "reasonable maximum exposure" scenario, and this is below U.S. EPA's target risk range of 1 x 10 -6 to 1 x 10 -4.

Adult Recreational User. The cumulative noncancer hazard index associated with the potential ingestion of fin fish, is 20.6, indicating a potential risk. The cumulation ingestion and dermal contact cancer risk is 8.0 x 10 -7 under a reasonable maximum exposure scenario, which is below U.S. EPA's target risk range of 1 x 10 -6 to 1 x 10 -4. The cancer risk associated with fin fish ingestion, however, is 6.8 x 10 -4, indicating a potential risk.

Child Recreational User. The cumulative noricancer hazard index and cancer risk associated with ingestion of and dermal contact exposure with surface and subsurface soil at Site 9 under industrial land use scenario are less than 1, and 9.1 x 10 -7, respectively, under a reasonable maximum exposure scenario.

Construction Worker. The cumulative noncancer hazard index and cancer risk associated with ingestion and dermal contact exposure to Site 9 soil under industrial land use conditions are 5.3 x 10 -1 and.44 x 104, respectively, under a reasonable maximum exposure scenario.

Although the incremental cancer risk for the construction worker slighby exceeded 1x10 -6, it is within U.S. EPAs target risk range of 1x10 -4 to 1x10 -6. Potential health hazards may be observed for adult recreational users who ingest contaminated finish. Since the risk to all other receptors is less than 10 -6, and the hazard indices for receptors are less than 1.0, human health risks under industrial land M conditions for those receptors are within acceptable risk ranges at Site 9.

2.5.2 Environmental Evaluation

The intent of the baseline ecological risk assessment (ERA) was to characterize potential receptors and to estimate the potential hazard or risk to environmental receptors. Wetland identifications, terrestrial wildlife inventories, vegetation surveys and macroinvertebrate inventories were performed in order to characterize the habitats associated with Site 9. Sample locations were selected to detect potential groundwater contamination discharging to nearby surface water bodies via the shallow aquifer as well as contaminants resulting from surface water runoff. Samples were collected from marshy areas near the site as well as points in Gambo Creek. Field work included sampling locations upstream, adjacent to, and downstream of Site 9 in Gambo Creek. Surface water, sediment, fish tissue, sediment toxicity, and macroinvertebrate community samples were taken from these locations, with the exception of fish tissue at the upstream location. Information from the Gambo Creek Ecological Assessment (EA) was also used to support the Site 9 evaluation.

Ecological effects quotients (EEOs) were derived for each COC in all media. An EEO represents the ratio of the maximum concentration of a constituent to an associated cleanup criteria or PRG. An EEO equal to or greater than 1.0 indicates a potential risk to ecological receptors. Based on EEOs and risk management factors, the following COCs are of greatest concern:

- Copper, lead, mercury, and zinc in surface water,
- DDD, DDE, DDT, Aroclor-1260, copper, and lead in sediments,
- DDT, copper, lead, mercury, and zinc in surface soils.

Based on elevated concentrations and risk levels of metals like copper, lead, and zinc in all three media, waste debris on Site 9 appears to be the source for the COCs.

Exposure Pathways

The exposure pathways consist of dermal absorption and ingestion of chemicals from soil, sediments, and surface water.

Exposure Assessment

Six contaminants in sediment (DDD, DDE, DDT, Aroclor-1260, copper, and lead), four contaminants in surface water (copper, lead, mercury, and zinc), and five contaminants in surface soils (DDT, copper, lead, mercury, and zinc) were identified as COCs for ecological receptors. The EEQ for each of these contaminants was greater than 1.

Potential Receptors

The organisms most likely to be ecological receptors, include mice, voles, rabbits, earthworms, ground insects, fish, and a variety of birds. Because of the natural setting of Site 9 and the variety of nearby habitats, Site 9 is likely to have a diversity of wildlife.

Risk Characterization

Based on risk management factors as well as potential risk levels, copper, lead, mercury, and zinc are concerns for surface water; DDD, copper, and lead are of concern in sediments; and DDT, copper, lead, mercury, and zinc are concerns for surface soils.

2.5.3 Development of Preliminary Remediation Goals (PRGs)

Contaminant fate and transport modeling was used to evaluate the potential for COCS identified by the human health and ecological risk assessment to migrate to other media and present unacceptable risks. For example, contaminants present in soils could migrate to groundwater or be carried with precipitation to surface water or sediments at a site. In order to evaluate this potential, fate and transport modeling was conducted for Site 9 using the ECTran model. The model uses contaminant properties such as the adsorption coefficient, and site-specific characteristics such as groundwater velocity, to predict acceptable levels of COCs in soil and groundwater that would be protective of surface water and sediment. Using regulatory criteria for surface water and toxicity data for sediment, preliminary remediation goals (PRGs) were developed by the modeling to determine if existing levels of COCs are acceptable. A complete discussion of the use of modeling and assumptions is presented in Appendix C of the Site 9 FS and Addendum FS.

Potential migration of COC's evaluated for Site 9 by the ECTran model included:

- Surface soil to surface water via runoff
- Surface soil to sediment via runoff
- Surface soil to surface water via groundwater
- Subsurface soil to surface water via groundwater
- Subsurface soil to sediment via groundwater
- Groundwater to surface water
- Groundwater to sediment

Based on potential migration, the following remedial action objectives (RAOs) are anticipated for Site 9 soil, sediments, and groundwater to address the primary exposure pathways. RAOs may be modified (made more stringent) during Remedial Design based on more detailed evaluation:

- Prevent ecological receptors from being directly exposed to 4,4-DDE, 4-4-DDT, arsenic, copper, lead, mercury, and zinc in surface soils at concentrations greater than 0.1 mg/kg, 0.1 mg/kg, 2.66 mg/kg, 50 mg/kg, 50 mg/kg, 0.0185 mg/kg, and 50 mg/kg, respectively.

- Prevent 4-4-DDD, 4-4-DDE, 4-4-DDT, copper, lead, mercury, silver, and zinc present in surface soil at concentrations greater than 0.028 mg/kg, 0.03 mg/kg, 0.018 mg/kg, 33 mg/kg, 44 mg/kg, 0.13 mg/kg, 0.31 mg/kg, and 259 mg/kg respectively from migrating from the surface soils and causing adverse effects to ecological receptors.

- Prevent copper, mercury, and silver present in subsurface soil at concentrations greater than 246 mg/kg, 0.13 mg/kg, and 0.31 mg/kg, respectively, from migrating to surface water via groundwater and causing adverse effects in ecological receptors.

- Prevent barium, copper, lead, mercury, manganese, nickel, silver, and zinc present in subsurface soil at concentrations greater than 182 mg/kg, 50.1 mg/kg, 386 mg/kg,

0.45, 958 mg/kg, 76.4 mg/kg, 6.31 mg/kg, and 523 mg/kg, respectively, from migrating to sediments via groundwater and causing adverse effects in ecological receptors.

- Prevent barium, cadmium, copper, lead, manganese, mercury, nickel, silver, and zinc present in groundwater at concentrations greater than 2,530 Ig/L, 17.05 Ig/L 655.8 Ig/L, 289 Ig/L, 8,790 Ig/L, 834.5 Ig/L, and 5,700 Ig/L, respectively, from moving to the creek surface water and sediment, and causing adverse effects in ecological receptors.

- Prevent ecological receptors from being exposed to marsh sediments contaminated with metals, pesticides/PCBs, and sernivolatile organic compounds listed in Table 2-3.

2.6 DESCRIPTION OF ALTERNATIVES

A detailed analysis of the possible remedial alternatives for Site 9 is included in the Site 9 Feasibility Study report. The detailed analysis was conducted in accordance with the U.S. EPA document entitled Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA and the National Oil Hazardous Substances Pollution Contingency Plan.

TABLE 2-3

SUMMARY OF SEDIMENT PRGs SITE 9 - (MG/KG)
NAVAL SURFACE WARFARE CENTER, DAHLGREN, VIRGINIA

Chemical of Concern	Preliminary Remediation Goals Protection of Sediment
2-Methylnaphthalene	0.67
4,4'-DDD	0.013
4,4'-DDE	0.031
4,4'-DDT	0.016
Anthracene	1.1
Aroclor-1254	0.067
Aroclor-1260	0.067
Arsenic	9.7
Benzo(a)anthracene	16
Benzo(a)pyrene	1.6
Benzo(b)flouranthene	4.8
Benzo(g,h,l)pyrene	4.8
Benzo(k)flouranthene	4.8
Cadmium	0.7
Chromium	28.8
Chrysene	2.8
Copper	30.0
Dibenzo(a, h) anthracene	0.26
Flouranthene	5.1
Fluorene	0.54
Indeno(1,2,3-cd) Pyrene	4.8
Lead	39.8
Mercury	0.2
Naphthalene	2.1
Nickel	34.3
Phenanthrene	1.5
Pyrene	2.6
Silver	2.8
Zinc	234

Because Site 9 is located adjacent to and partially in the marsh, which is the area of local groundwater discharge, collection and treatment of contaminated groundwater is impractical. The shallow groundwater beneath Site 9 is not currently or reasonably expected to be a source of drinking water and when institutional controls are implemented, will be restricted from any use, except monitoring. Additionally, containment of and diversion of groundwater from contaminant sources by installing an upgradient slurry cutoff wall will control release of contaminants to the environment to levels which are protective of the environment, For Site 9, under all the alternatives, except the No Action altemative, an institutional control plan will be developed as part of the remedial action design and include: access controls, signs along the perimeter of the site, restrictions on shallow groundwater use for drinking water, description of land use controls in the base master plan, periodic inspection, monitoring, and re-evaluation of land use controls, annual certification that institutional controls are in place, notification to the U.S. EPA and state regulators whenever the Navy anticipates any major changes in land use restrictions, public notice, and a deed notification.

The following institutional controls are part of every alternative except the No Action alternative, and shall be undertaken within 90 days of completion of remedial construction: a real property description notation, Base Master Plan notations, and limited site access.. The Base Master Plan shall note the area as one in which residential development can not occur, shallow groundwater can not be used, and site access shall be limited. A notation shall be filed in the real property file maintained at EFA Ches for this site indicating the extent of the area and the fact that solid wastes are present. The institutional controls shall also include the following: Within 90 days after completion of the remedy, the Navy shail produce a survey plat prepared by a professional land surveyor registered by the Commonwealth of Virginia indicating the location and dimensions of the disposal area and the extent of groundwater contamination. Monitoring well locations shall be included and identified on the survey plat. The plat shall contain a note, prominently displayed, which states the owner's future obligation to restrict disturbance (excavation or construction) of the property; post-closure use of the property shall prohibit residential use and access or use of groundwater underlying the property for any purpose except monitoring, and the function of the monitoring systems shall not disturbed. The owner of the property shall submit the survey plat to the local recording authority when closure is complete. When landfill closure is complete, the owner of the property shall submit the survey plat to the local recording authority, and shall record a notation with the deed (or some other instrument which is normally examined during title search at the local land recording authority notifying any potential purchaser of the property that the land has been used to manage solid waste and the integrity of the cover system or the function of the monitoring system may not be disturbed.

A summary of the remedial alternatives which were developed to address contamination associated with Site 9 is presented below.

The following lists the primary components of each of the alternatives developed for Site 9. Each of Alternatives 2 through 5 include institutional controls, surface water controls, and vegetation restoration as appropriate.

- Alternative 1 No Action
  Landfill: No Action
  Marsh Area: No Action
  Southern Portion: No Action

- Alternative 2 Landfill Cap and Waste/Fill Excavation in Marsh
  Landfill: Multilayer Cap
  Marsh Area: Excavate All Waste Material
  Southern Portion: Remove Surface Debris/Surface Soil
  Options: A

- Alternative 3 Landfill Cap and Marsh Cap
  Landfill: Multilayer Cap
  Marsh Area: Remove Surface Debris and Place Marsh Cap Over All Waste Material
- Southern Portion: Remove Surface Debris/Surface Soil
  Options: A, B1, B2, B3

- Alternative 4 Landfill Cap and Surface Sediment Removal in Marsh
  Landfill: Multilayer Cap
  Marsh Area: Excavate Surface Debris and Surface Sediments in Excess of PRGs

- Southern Portion: Remove Surface Debris/Surface Soil
  Options: A, B1, B2, B3

- Alternative 5 Landfill Cap and Surface Debris Removal in Marsh
  Landfill: Multilayer Cap
  Marsh Area: Remove Surface Debris
  Southern Portion: Remove Surface Debris/Surface Soil
  Options: A, B1, B2, B3

The following lists the options which were considered with Alternatives 2 through 5. Option A involves placing a vertical slurry wall on the upgradient side of the landfill to reduce the amount of groundwater flow through the landfill. The B options involve different methods of satisfying the requirement for a 100 foot setback from Gambo Creek. The options are listed below.

- Option A Construct a slurry wall on the upgradient side of the landfill.

- Option B1 Remove all waste within 100 feet of Gambo Creek. Backfill with clean soil and revegetate.

- Option B2 Place shoreline protection along the streambank anywhere the waste/fill material is within 100 feet of Gambo Creek.

- Option B3 Relocate or fill in Gambo Creek so that it is at least 100 feet from waste/fill material in the marsh.

As can be seen from the preceding lists, capping of the landfill is included in all of the alternatives involving an action. Also, removal of surface debris and surface soil from the southern portion of the site is included. Capping is the only action remedy considered for the landfill based on the containment presumptive remedy and site specific conditions. Option A can be used to supplement the containment remedy for the landfill. Since capping is a component of all of the action alternatives, it is coupled with institutional controls, monitoring, and removal of surface debris from the southern portion of the site since these components are also common to all of the action alternatives. A brief description of each alternative and option is provided below.

Alternative 1: No Action

Under this alternative, no further effort or resources would be expended at Site 9. Alternative 1 serves as the baseline against which the effectiveness of the other alternatives is judged.

The following costs are associated with this alternative:

Present Worth($):	15,550/5 yr (Estimated administrative cost of 5-year review of remedial action over a 30-year period
Time to Implement:	0 months

Alternative 2: Landfill Cap and Waste/Fill Excavation In Marsh

Alternative 2, involves constructing a multilayer cap over the landfill portion of Site 9. The construction of the landfill cap consists of four major components; (1) Regrading and consolidation of wastes, (2) Construction of the cap components, (3) Installation of surface water controls including revegetation, and (4) Institutional controls and monitoring. This alternative also involves removal of surface debris from the southeast area of the site and removal of contaminated surface soil. The soil and surface debris would be consolidated under the multilayer cap. Surface sediments from the ditch bordering the southern edge of the landfill would also be excavated and consolidated under the cap.

Removal of waste/fill material from the marsh involves four major components: (1) Excavation of waste/fill material in the marsh, (2) Consolidation of the material under the cap, (3) Revegetation and restoration of the marsh, and (4) Surface water controls including shoreline protection.

This alternative can also be coupled with Option A which will be discussed at the end of this section. The B options are not included as part of Alternative 2 because all of the wasteffill would be removed ftwm!h~ wetland which will satisfy the 100 loot off-set requirement for Gambo Creek.

Landfill Cap - Wastes and surface soil removed from the southern area of the site and the marsh would be consolidated and stabilized on the landfill portion of the site. It is estimated that approximately 250 cy of waste would be removed from the southern area of the site. Waste excavated from the wetland would also be consolidated under the multilayer cap. Consolidation may include size separation, crushing and grinding. The landfill, estimated to be approximately 5.0 acres upon completion of closure activities, would be capped with a multilayer cap meeting the requirements of the Virginia Solid Waste Management Regulations, 9 VAC 20-80-210 (Remedial Requirements) and 9 VAC 20-80-250 (sanitary landfill). The landfill cap will limit precipitation and runoff entering the consolidated fill material. It is anticipated that the multilayer cap will need to exceed the minimum requirements of a 9 VAC 20-80-250 (sanitary landfill), based on preliminary modeling conducted for the remedial design, to be protective of receptors in Gambo Creek. The final cap components will be determined during the final design for Site 9. The multilayer cap will be revegetated, and the closure completed consistent with 9 VAC 20-80-250 (sanitary landfill) closure requirements. The closure would include provisions for the installation of structures at the toe of the landfill and elsewhere to provide erosion and sediment control measures including protection from surges the water surface of Gambo Creek due to major regional storm events such as hurricanes. The current boundary of the landfill will be pulled back from Gambo Creek so that the waste associated with the cap will be a minimum of 100 feet from Gambo Creek.

Institutional controls, including limiting site access through access gates and future land use through a deed notation would be implemented to eliminate or reduce pathways of exposure to contaminants at the site. Groundwater, surface water, and sediments would be addressed through the above source controls plus monitoring to determine it contaminants are migrating at significant rates and concentrations.

Removal of Waste/Fill Material in the Marsh - Under Alternative 2, all wastes would be excavated from the marshy area of the site, consolidated and stabilized on the landfill. It is estimated that approximately 18,000 cy of waste/fill material would be removed from the marsh.

Once the material is excavated from the marsh, the material will be required to be stabilized before it can be consolidated on the landfill portion of Site 9.

Option A - This option is to improve the performance of the remedy by reducing the movement of groundwater through the landfill. The option would consist of installing an upgradient groundwater control such as an impermeable wall (slurry wall) on the hydraulically upgradient (west) side of the landfill, effectively redirecting groundwater movement around the capped landfill. The slurry wall would be installed to a depth below grade and keyed into the clay confining unit beneath the site.

This remediation alternative would operate indefinitely. Annual operations and maintenance (O&M) costs include annual landfill closure monitoring costs, including 5-year reviews under CERCLA for 30 years.

Capital Cost:	$7,773,891 (without Option A)
	$8,539,899 (with Option A)
Annual O&M:	$33,350 + $15,500 every 5 years
Present Worth:	$8,421,149 (without Option A)
	$8,987,157 (with Option A)
Time to Implement:	6 months

Alternative 3: Landfill Cap and Marsh Cap

This alternative consists of the several components which were described in Alternative 2 including: the landfill cap, removal of surface sediments, surface debris, and surface soil removal from the southern portion of the Site, Option A, institutional controls, and monitoring. This information is not repeated here.

Alternative 3 provides a different remedy for the wastelfill material in the marsh (marsh cap) and includes the three B options for achieving the 100 foot offset of waste from Gambo Creek.

Marsh Cap - The marsh cap consists of three major components: (1) removal of surface debris in the marsh and consolidation onto the main portion of the landfill, (2) installation of a geogrid and cap over the marsh area of the site, and (3) revegetating the marsh.

Under Alternative 3, surface debris would be removed (excavated) from the marshy area of the site and consolidated and stabilized on the landfill. It is estimated that approximately 260 cy of surface debris would be removed from the marsh. Vegetation in the marshy area of the site would be cut back. If

required, a geogrid would be placed and anchored over the entire 2.4 acre area. The placement of the geogrid over the marsh would improve the lateral stability of the soils in the area, and allow construction equipment to complete the placement of the cap over the waste disposal areas in the marsh. The marsh cap would meet the minimum thickness requirements (2 feet) of Virginia Sanitary landfill cap. The marsh cap would provide sound engineering controls per 9 VAC 20-80-250 to help control groundwater which intrudes the site by being constructed to an elevation (estimated to be 4 feet msl) which would preclude the possibility of groundwater migration upward through the waste material and reaching the cap surface. The marsh cap will address 9 VAC 20-80-250 requirements to control releases or otherwise reduce site risks by: 1).cutting off potential contact exposure to wastes in the marsh; 2) enhancing evaporation of contaminated groundwater which flows within the marsh cap; and 3) providing additional sorbing soils
through which the contaminated groundwater must pass before being discharged to the marsh. Upon completion of the placement of the marsh cap, appropriate vegetation would be re-introduced and maintained. Installation of the marsh cap would raise the elevation of the marsh and would likely turn the capped area into an upland. The wetland loss would be mitigated elsewhere at the NSWCDL facility.

Option B1 - Remove All Waste in the Marsh Area from Within 100 Feet of Gambo Creek - This option would be very similar to Alternative 2 where all of the waste is excavated from the Marsh area except a smaller area would be excavated. Approximately 8,730 c.y. would be excavated from the marsh.

Because the waste will be removed from a substantial area of the marsh, the marsh cap would be reduced to 39,700 square feet.

Option B2 - Shoreline Protection - Under this option, the shoreline of Gambo Creek would be protected against erosion to provide a benefit equivalent to moving waste 100 feet away from Gambo Creek. This protection would be provided where Gambo Creek is within 100 feet of the waste/fill material In the marsh. Shoreline protection requirements would be determined during the Remedial Design based on detailed hydrologic/hydraulic analysis. It is conservatively assumed that the shoreline protection will consist of performing spot regrading of the Gambo Creek stream bank, placement of a geotextile, and placement of riprap to the same elevation as the existing stream bank. It is anticipated that 560 linear feet of shoreline protection will be required.

Option B3 - Relocation or Fill in Gambo Creek - This option involves rechanneling Gambo Creek so that it does not flow within 100 feet of wasteffill material. Portions of Gambo, Creek would be filled, and restored as wetlands. Other areas of the marsh would be excavated for the new channel and provide the equivalent channel volume of open water as was lost due to filling activities. It is anticipated that sheet piling would be required to facilitate the excavation and filling operations. The sheet piling would separate the flow in Gambo Creek from the excavation and fill areas to limit the sediment that would enter the creek during excavation. Approximately 0.6 acres of Gambo Creek would be filled. Material excavated from the marsh would be used to fill Gambo Creek. Approximately 4,315 cy of material would be excavated and filled.

This remediation alternative would operate indefinitely. Annual O&M costs include landfill, groundwater, and surface water and sediment monitoring costs and a report evaluating waste in place, which would occur every 5 years for 30 years.

Capital Cost	
Option B1:	$6,682,409 (without Option A)
	$7,248,417 (with Option A)
Option B2:	$2,981,059 (without Option A)
	$3,547,067 (with Option A)
Option B3:	$3,776,396 '(without Option A)
	$4,342,404 (with Option A)
Annual O&M:	$33,350 + $15,500 every five years
Present Worth:	
Option B1:	$4,223,654 (without Option A)
	$4,789,662 (with Option A)
Time to Implement:	6 months

Alternative 4: Landfill Cap and Surface Sediment Excavation in Marsh

This alternative consists of the several components which were described In Alternative 2, including: the landfill cap, surface sediment removal from the ditch south of the landfill, surface debris/surface soil removal from the southern portion of the Site, Option A, institutional controls, and monitoring. This information is not repeated here,

Alternative 4 provides a different remedy for the wasteffill material in the marsh (surface sediment removal) and includes the three B options to keep waste 100 feet away from Gambo, Creek. The three B options are the same as described under Alternative 3.

Surface Sediment ~Excavation in Marsh - Surface sediment excavation consists of three major components: (1) excavation of surface debris in the marsh and consolidation onto the main portion of the landfill, (2) excavation of 1 foot of contaminated surface sediments and consolidation onto the main portion of the landfill, and (3) revegetating the marsh.

Under Alternative 4, surface debris would be removed (excavated) from the marsh area, consolidated, and stabilized on the landfill. Contaminated surface sediments within the limit of waste in the marsh would also be excavated to address ecological risks from direct contact. The surface sediment would be consolidated on the landfill, It is estimated that approximately 260 cy of surface debris from the marsh, and 2,900 cy of surface sediments from selected areas of the marsh would be excavated. Contaminated surface sediment would be excavated to a depth of 1 foot below grade and backfilled. The 1 foot depth would be sufficient to prevent direct contact from most ecological receptors. Wastes removed from the marsh would be replaced with clean fill and the area revegetated to restore these areas to their original or enhanced condition.

This remediation alternative would operate indefinitely. Annual O&M costs include landfill, groundwater, and surface water and sediment monitoring costs and a report evaluating waste in place, which would occur every 5 years for 30 years.

Capital Cost:		
	Option Bl:	$6,768,684 (without Option A)
		$7,354,892 (with Option A)
	Option B2:	$2,974,508 (without Opbon A)
		$3,540,516 (with Option A)
	Option B3:	$3,769,845 (without Option A)
		$4,335,853 (with Option A)
Annual OM		$33,350 + $15,500 every five years
Present Worth:		
	Option B1:	$7,236,142 (without Option A)
		$7,802,150 (with Option A)
	Option B2:	$3,421,766 (without Option A)
		$3,987,774 (with Option A)
	Option B3:	$4,217,103 (without Option A)
		$4,783,111 (with Option A)
Time to Implement:		6 months

Alternative 5: Landfill Cap and Surface Debris Removal in Marsh

This alternative consists of the several components which were described in Alternative 2 including: the landfill cap, surface debris removal from the southern portion of the Site, Option A, institutional controls, and monitoring. This information is not repeated here.

Alternative 5 provides a different remedy for the waste/fill material in the marsh (surface debris removal) and includes the three B options for achieving the 100 foot offset of waste from Gambo Creek. The three B options are the same as described under Alternative 3.

Surface Debris Removal in Marsh - Surface debris removal consists of 2 major components: (1) excavation of surface debris in the marsh and consolidation onto the main portion of the landfill, and (2) revegetating the marsh.

Under Alternative 5, surface debris would be removed (excavated) from the marsh area, consolidated, and stabilized on the landfill. This alternative relies on the reduction in contaminant migration afforded by capping the landfill and proposes only minimal disturbance to the marsh habitat.

It is estimated that approximately 260cy of surface debris would be excavated from the marsh. Wastes removed from the marsh would be replaced with clean fill and the area revegetated to restore these areas to their original or an enhanced condition.

This remediation alternative would operate indefinitely. Annual O&M costs include landfill, groundwater, and surface water and sediment monitoring costs and a report evaluating waste in place, which would occur every 5 years for 30 years.

Capital Cost	
Option B1:	$6,380,802 (without Option A)
	$6,946,810 (with Option A)
Option B2:	$2,392,976 (without Option A)
	$2,958,984 (with Option A)
Option B3:	$3,188,313 (without Option A)
	$3,754,321 (with Option A)
Annual O&M:	$33,350 + $15,500 every five years
Present Worth:	
Option Bl:	$6,828,060 (without Option A)
	$7,394,068 (with Option A)
Option B2:	$2,840,234 (without Option A)
	$3,406;242(with Option A)
Option B3:	$3,635,571 (without Option A)
	$4,201,579(with Option A)
Time to Implement:	6 months

2.7 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

The remedial alternatives described in Section 2.6 were evaluated in the Feasibility Study against nine criteria identified in the NCP, as presented below.

2.7.1 Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative 3 provides the highest level of overall protection to human health and the environment by preventing transport of, and plant and animal contact with, contaminants through the containment of wastes within the landfill and marsh area. Alternative 2 provides a high level of protection because all waste material is removed from the marsh area, but requires a significant disturbance of the marsh area during construction with a greater possibility of contaminants being released during construction. Alternative 4 provides less overall protection than Alternative 3 and requires more disturbance of the marsh area during construction with a possibility of contaminants being released during construction. Alternative 5 provides less overall protection in the marsh than Alternative 4 because contaminated sediment is neither removed or contained. Alternative 1 provides the least overall protection because no action would be taken to reduce contaminant movernoent and contaminated soil and sediment is neither removed nor contained.

Option A (slurry wall) would enhance the protectiveness of the landfill cap under all alternatives. The slurry wall prevents groundwater from coming into contact with materials buried in the landfill and reduces potential movement of contaminants to the environment

Option B2 provides a high level of overall protection by preventing potential erosion of buried waste within the marsh. Option B3 provides a high level of protection but requires significant disturbance of Gambo, Creek northeast of the landfill during construction with a greater possibility of affecting water quality due to resuspension of sediment within Gambo Creek.

Option B1 provides a high level of protection but requires significant disturbance of the marsh area during construction with a greater possibility of contaminants being released during construction.

Every alternative except the No Action alternative implements measures to control sources of contamination and exposure to humans and the environment to residual contamination, as necessary to protect human health and the environment. This includes permanent notification in local land records of groundwater use restrictions in order to control exposure of humans to residual contamination in groundwater, and containment of and diversion of groundwater from contaminant sources by installing an upgradient slurry cutoff wall in order to control release of contaminants to the environment to levels which are protective of the environment.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Groundwater chemical-specific ARARs (MCLs) would not likely be attained at Site 9 during the project life under any of the alternatives. Because Site 9 is located adjacent to and partially in the marsh, which is the area of local groundwater discharge, collection and treatment of contaminated groundwater is impractical. The groundwater is not currently or reasonably expected to be a source of drinking water and when Institutional controls are implemented, will be restricted from any use, except for monitoring.

Alternative 3 would achieve remediation goals and compliance with ARARs and To Be Considered (TBC) requirements. Under Alternative 3 buried waste would remain in the marsh area. Long term monitoring with the opportunity to implement additional measures, if warranted, would mitigate such concerns. Alternative 2 would meet remediation goals, ARARs, and TBCs but requires more disturbance of the marsh area during construction with a possibility of contaminants being released during construction. Alternative 4 would meet remediation goals but also requires more disturbance of the marsh area during construction with a possibility of contaminants being released during construction. Alternative 5 is least likely to meet remediation goals, ARARs, and TBCs because contaminated sediment is neither removed nor contained. Alternative 1 would not meet remediation goals, ARARs, and TBCs because no action would be taken to reduce contaminant movement and contaminated soil and sediment is neither removed nor contained.

Option A (slurry wall) would enhance the ability of the landfill cap to meet remediation goals, ARARs, and TBCs under all alternatives. The slurry wall prevents groundwater from coming into contact with materials buried in the landfill.

Option 82 meets remediation goals, ARARs, and TBCs by providing protection equivalent to that required to comply with the ARAR. Options B1 and B3 meet the ARARs by providing the 100 foot separation distance.

Appendix C is a table of the ARARs for Site 9.

2.7.2 Primary Balancing Criteria

Reduction of Toxicity, Mobility, and Volume

Alternative 3 reduces the mobility of contaminants present in the landfill and marsh area by capping the waste. Alternative 2 reduces the mobility of contaminants present in marsh area by removing them and placing them under the landfill cap. Alternative 4 reduces the mobility of contaminants present in the marsh area by removing some of them and placing them under the landfill cap while covering the remaining waste/fill material with clean soil. Alternative 6 does not reduce the mobility of contaminants present in the marsh and reduces the mobility of contaminants in the landfill by capping. Alternative 1 does not reduce the mobility of contaminants at Site 9. None of the alternatives reduce toxicity or volume of waste through treatment because it would be cost prohibitive due to the large volume of waste present at the site.

Option A (slurry wall) would enhance the ability of the landfill cap to reduce the mobility of contaminants under all alternatives. The slurry wall prevents groundwater from coming into contact with materials buried in the landfill.

Option B2 reduces the potential mobility of contaminants by preventing potential erosion of buried waste within the marsh. Options B1 and B3 reduce the potential mobility of contaminants by providing the 100 foot separation distance.

Long-term Effectiveness

Alternative 3 is expected to be effective in the long term. Under Alternative 3 buried waste would remain in the marsh area. Long term monitoring with the opportunity to implement additional measures, if warranted, will mitigate such concerns. Long-term effectiveness is expected to be somewhat better for Alternative 2 because all waste is removed from the marsh area and somewhat less effective for Alternative 4 since waste left in the marsh would not have a marsh cap. Alternative 5 is not expected to be effective In the long term because surface sediments that do not meet cleanup goals would remain in the marsh. Alternative 1 would not be effective in the long term because it does not protect the environment.

Option A (slurry wall) is expected to be very effective in the long term. All of the B Options are expected to be effective in the long term by providing protection from erosion of the waste material in the marsh.

Short-term Effectiveness

Alternative 3 would be the most effective in the short term because it does not require disturbance of waste materials buried in the marsh thereby reducing the short term exposure and potential releases of contaminants to the environment. Construction operations associated with Alternatives 2 and 4 would significantly disturb waste buried in the marsh, thereby reducing the short-term effectiveness. Although Alternative 5 would provide the least amount of disturbance in the marsh, it would not be effective because plants and animals remain exposed to contaminated sediment.

Option A (slurry wall) is expected to be very effective in the short term. Option B2 would be completed in a shorter amount of time than B1 and B3, and would have a smaller impact on the marsh. Construction operations for Options B1 and B3 would disturb large areas of the marsh and Gambo Creek.

Implementability

Alternative 3 and Option B2 are the most easily implemented, although all the alternatives can be implemented using conventional, well-demonstrated, and commercially available technologies. Alternative 1 requires no implementation. Alternatives and options which involve removing waste, soils, or surface sediments present common implementability issues which can be overcome. Alternative 2 would involve excavating all waste buried in the marsh area and would be the most difficult alternative to implement. Option B3 would involve relocating Gambo Creek and would be the most difficult of the B options to implement.

Cost

Alternatives 3, 4, and 5 are relatively similar in costs. Alternative 2 is the highest cost alternative ($8,990,000) while Alternative 5 is the least cost afternative ($2,840,000). The cost of implementing the alternatives increases dramatically with the amount of waste removed from the marsh area.

Option A costs approximately $566,000 for all the alternatives. Of the B options, costs increase significantly as more materials are removed from the marsh. Option B2 is the least cost option while Option B1 is the highest cost option.

2.7.3 Modifying Criteria

State Acceptance

The Virginia Department of Environmental Quality, on behalf of the Commonwealth of Virginia, has reviewed the information available for this site and has concurred with this ROD and the selected remedy identified below. A copy of the concurrence letter from the Commonwealth of Virginia is attached as Appendix A

Community Acceptance

Community acceptance summarizes the public's general response to the alternatives described in the Proposed Plan and the Feasibility Study. No written comments were received during the thirty-day comment period which began on August 20, 1998 and ended on September 18, 1998. There were no formal comments or questions received it the Proposed Plan public meeting held on August 27, 1998. The background on community involvement is included in the Responsiveness Summary, Section 3.0 of the ROD.

2.8 THE SELECTED REMEDY

Alternative 3 with option A (upgradient groundwater control), option B2 to the north, (shoreline protection), and B3 to the south (fill Gambo Creek and restore as wetlands) is the selected remedial alternative, utilizing capping to address both soils and sediments. Based on available information and the current understanding of site conditions, the selected rernedy appears to provide the best balance with respect to the nine NCP evaluation criteria. The selected remedy is shown in Figure 2-6. In addition, the selected remedy is anticipated to meet the following statutory requirements:

- Protection of human health and the environment.
- Compliance with ARARs.
- Cost-effectiveness.

The selected remedy would address the contamination at Site 9. The selected remedy is estimated to turn 2.4 acres of wetland (marsh soil cap area) to upland and create 1.0 acre of new wetland (area to be excavated for cap construction and portions of Gambo Creek to be filled) at Site 9 (Figure 2-6). Additional

wetland acreage will be created elsewhere at the NSWCDL facility to mitigate the wetland loss.

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Institutional controls will be implemented to limit future site land use. For Site 9, an institutional control plan will be developed as part of the remedial action design and include: access controls, signs along the perimeter of the site, restrictions on shallow groundwater use for drinking water, description of land use controls in the base master plan, periodic inspection, monitoring, and re-evaluation of land use controls, annual certification that institutional controls are in place, notification to the U.S. EPA and state regulators whenever the Navy anticipates any major changes in land use restrictions, public notice, and a deed notification.

The Navy shall institute the following institutional controls within 90 days of completion of all remedial actions: a real property description notation, Base Master Plan notations, and limited site access. The Base Master Plan shall note the area as one in which residential development can not occur, shallow groundwater can not be used, and site access shall be limited. A notation shall be filed in the real property file maintained at EFA Ches (US Navy) for this site indicating the extent of the area and the fact that solid wastes are present. The institutional controls shall also include the following: Within 90 days after completion of the remedy, the Navy shall produce a survey plat prepared by a professional land surveyor registered by the Commonwealth of Virginia indicating the location and dimensions of the disposal area and the extent of groundwater contamination. Monitoring well locations should be included and identified on the survey plat. The plat shall contain a note, prominently displayed, which states the owners future obligation to restrict disturbance (excavation or construction) of the property; post-closure use of the property shall prohibit: residential use and access or use of groundwater underlying the property for any purpose except monitoring and the function of the monitoring systems shall not be disturbed. When landfill closure is complete, the owner of the property shall submit the survey plat to the local recording authority, and shall record a notation with the deed (or some other instrument which is normally examined during title search at the local land recording authority) notifying any potential purchaser of the property that the land has been used to manage solid waste and the integrity of the cover system or the function of the monitoring system may not be disturbed.

The Navy shall institute groundwater monitoring to ensure the RAOs are being maintained. Monitoring of surface water and sediments shall be implemented to measure concentrations of these constituents. The frequency of analysis and the length of time for groundwater, surface water, and sediment monitoring shall be developed in the Operation and Maintenance Plan.

Based on available information and the current understanding of site conditions, Alternative 3 appears to provide the best balance with respect to the nine NCP evaluation criteria. In addition, the selected alternative is anticipated to meet the following statutory requirements:

- Protection of human health and the environment.
- Compliance with ARARs.
- Cost-effectiveness.

The institutional controls will further protect human health and the environment by limiting future land use and by providing continuous monitoring.

2.8.1 Performance Standards

The selected remedy shall be capable of managing residuals and achieving all RAOs within the boundaries of Site 9 and shall meet all ARARs and TBCs for the site.

Landfill Cap

The landfill cap shall be designed, constructed, operated, and maintained to meet or exceed the performance requirements of RCRA Subtitle D regulations specified in 40 CFR °° 258.60-61 and Virginia Solid Waste Management Regulations, 9 VAC 20-80-210 (Remedial Requirements) and 9 VAC 20-80-250 (Sanitary Landfill).

The cap design shall minimize infiltration, and control surface water run on/runoff. The landfill cap shall be constructed, at a minimum to the following performance standards: a 6-inch vegetative and protective layer and a 18-inch infiltration layer with a hydraulic conductivity less than or equal to any natural soils below the waste but not greater than 1 x 10 -5 cm/sec.

Surface water drainage controls shall be constructed to prevent erosion of the cap. As determined by the final Site 9 Cap Design, drainage channels shall be installed in certain areas on the top and perimeter of the landfill cap to channel runoff away from the landfill.

Slurry Wall

The slurry wall will address 9 VAC 20-80-250 (Sanitary Landfill) and 9 VAC 20-80-210 (Remedial Requirements) by providing engineering control to reduce groundwater intrusion and flow through wastes by diverting up-gradient groundwater flow away from the landfill. This will reduce groundwater levels and slow contaminant release from the landfill.

Marsh Cap

The marsh cap shall meet the minimum thickness requirements (2 feet) of Virginia Sanitary landfill cap. The marsh cap shall provide sound engineering controls per 9 VAC 20-80-250 to help control groundwater which intrudes the site by being constructed to an elevation (estimated to be 4 feet msl) which would preclude the possibility of groundwater migration upward through the waste material and reaching the cap surface. The marsh cap will address 9 VAC 20-80 250 requirements to control releases or otherwise reduce site risks by: 1) cutting off potential contact exposure to wastes in the marsh; 2) enhancing evaporation of contaminated groundwater which flows within the marsh cap; and 3) providing additional sorbing soils through which the contaminated groundwater must pass before being discharged to the marsh.

Shoreline Protection

The shoreline of Gambo Creek shall be protected against erosion of wastes buried in the marsh. This protection would be provided where Gambo Creek is within 100 feet of the wastelfill material in the marsh north of Site 9. Shoreline protection requirements would be determined during the Remedial Design based on detailed hydrologic/hydraulic analysis.

Fill In Gambo Creek

South of Site 9, portions of Gambo Creek shall be filled, and restored as wetlands so that Gambo Creek does not flow within 100 feet of waste/fill material.

Monitoring Wells

A groundwater monitoring network shall be implemented in accordance with RCRA and VSWMR. It shall be installed at the perimeter of the unit to evaluate any future contaminant transport. The location and number of monitoring wells, the frequency of analyses, and the types of analyses shall be determined in the site design and operation and maintenance documents. These documents must be approved by the EPA and the Commonwealth of Virginia. Groundwater monitoring shall be determined in the site design and operation and maintenance documents per 9 VAC 20-8-250.D.6 (Assessment Monitoring Program) and 9 VAC 20-80-310 (Corrective Action Program). The wells shall be installed according to RCRA and Commonwealth of Virginia construction requirements.

Surface Water and Sediment

A surface water and sediment sampling and monitoring plan shall be developed as part of the Operation and Maintenance (O & M) Plan. The location and number of sampling locations, the frequency of analyses, the types of analyses, and the duration of monitoring shall be determined in the O & M Plan. This plan must be approved by the EPA and the Commonwealth of Virginia.

Institutional Controls

Institutional controls will be implemented to limit future site land use. For Site 9, an institutional control plan will be developed as part of the remedial action design and include: access controls, signs along the perimeter of the site, restrictions on shallow groundwater use for drinking water, description of land use controls in the base master plan, periodic inspection, monitoring, and re-evaluation of land use controls, annual certification that institutional controls are in place, notification to the U.S. EPA and state regulators whenever the Navy anticipates any major changes in land use restrictions, public notice, and a deed notification.

The Navy shall institute the following institutional controls within 90 days of completion of all remedial

actions: a real property description notation, Base Master Plan notations, and limited site access. The Base Master Plan shall note the area as one in which residential development can not occur, shallow groundwater can not be used, and site access shall be limited. A notation shall be filed in the real property file maintained at EFA Ches (US Navy) for this site indicating the extent of the area and the fact that solid wastes are present. The institutional controls shall also include the following: Within 90 days after completion of the remedy, the Navy shall produce a survey plat prepared by a professional land surveyor registered by the Commonwealth of Virginia indicating the location and dimensions of the disposal area and the extent of groundwater contamination. Monitoring well locations should be included and identified on the survey plat. The plat shall contain a note, prominently displayed, which states the owners future obligation to restrict disturbance (excavation or construction) of the property; post-closure use of the property shall prohibit residential use and access or use of groundwater underlying the property for any purpose except monitoring and the function of the monitoring systems shall not be disturbed. When landfill closure is complete, the owner of the property shall submit the survey plat to the local recording authority, and shall record a notation with the deed (or some other instrument which is normally examined during title search at the local land recording authority) notifying any potential purchaser of the property that the land has been used to manage solid waste and the integrity of the cover system or the function of the monitoring system may not be disturbed.

The Navy shall institute groundwater monitoring to ensure RAOs are being met. The frequency of analysis and the length of time for groundwater, surface water, and sediment monitoring shall be developed in the Operation and Maintenance Plan.

2.9 STATUTORY DETERMINATIONS

Remedial actions must meet the statutory requirements of Section 121 of CERCLA 42 U.S.C. 9621 as discussed below.

Remedial actions undertaken at NPL sites must achieve adequate protection of human health and the environment, comply with ARARs of both Federal and state laws and regulations, be cost-effective, and utilize, to the maximum extent practicable, permanent solutions and alternative treatment or resource recovery technologies. Also, remedial alternatives that reduce the volume, toxicity, and/or mobility of hazardous waste as the principal element are preferred.

The following discussion summarizes the statutory requirements that are met by the selected remedy.

@.9.1 Protection of Human Health and the Environment

The selected remedy implements measures to control sources of contamination and exposure to humans or the environment to residual contamination, as necessary to protect human health and the environment. This includes permanent notification in local land records of groundwater use restrictions in order to control exposure of humans to residual contamination in groundwater, and containment of and diversion of groundwater from contaminant sources by installing an upgradient slurry cutoff wall in order to control release of contaminants to the environment to levels which are protective of the environment.

Multilayer Cap - The multilayer cap would protect human health and the environment by preventing direct exposure to contaminated soil and minimizing the potential of contaminant migration to the surface water and sediment via groundwater. Removal of surface debris and contaminated surface soils from the southern portion of the site would remove the potential threat of this debris to both human and ecological receptors. Implementation of institutional controls will assure that the site will not be used for any purpose in the future which could damage the cap and potentially expose human and ecological receptors to the waste in the landfill.

Marsh Cap - The marsh cap would protect against erosion of the waste/fill material and would increase the separation distance between the waste/fill material and the marsh surface. The marsh cap would prevent direct contact of the waste/fill materials with ecological receptors. The marsh cap would not prevent leaching of contaminants from the underlying waste/fill material, however, the cap will be placed at an elevation which is sufficient to prevent any contaminants from leaching to the surface and contaminating the surface soils in the cap where the ecological receptors could contact the contaminants.

While contaminant migration from the subsurface is possible, it is unlikely. A small upward gradient exists from the upper confined aquifer into Gambo Creek which could mobilize contaminants to the surface. Although this gradient exists, the clay confining unit below the creek is estimated to be approximately 30 feet thick so that the upward flow of groundwater through this waste material would be very small

(estimated to be 0.25 inches/year). Tidal flushing is much more significant than flow from the upper confined aquifer. In addition, the rnobility of contaminants in the marsh is considered to be low due to the types of contaminants.

Option - Option A (construct a slurry wall on the upgradient side of the landfill) will provide additional protection of human health and the environment by reducing the potential for groundwater to come into direct contact with waste materials in the landfill.

Option B2 - Option B2 (shoreline protection along the streambank north of the marsh) would provide additional protection of human health and the environment by providing shoreline protection which, will greatly reduce the potential for waste material to erode from the marsh and migrate further from Site 9.

Option B3 - Option B3 (filling Gambo Creek and restoring it as wetlands in the area adjacent to waste south of the marsh) will also provide additional protection of human health and the environment by lessening the potential for the stream channel of Gambo Creek to erode into the waste/fill material.

2.9.2 Compliance with ARARs

Measures to control sources of contamination and exposure to humans or the environment to residual contamination may be implemented provided: the groundwater protection standard cannot be practically achieved; the groundwater is not currently or reasonably expected to be a source of drinking water and is not hydraulically connected with waters to which contaminants may migrate in concentrations that would exceed applicable standards; and the measures are consistent with the overall objective of the remedy, i.e., to control the sources of releases so as to reduce or eliminate, to the maximum extent practicable further releases of solid waste constituents into the environment that may pose a threat to human health or the environment [9 VAC 20-80-310.B.2; B.5; C.3]. The selected remedy for Site 9 will satisfy these criteria.

Multilayer Cap - The cap would meet all relevant and appropriate regulations and federal and state law. The waste in the landfill would not be situated within 100 feet of a flowing surface water body (Gambo Creek) as required by Virginia regulabons. The toe of the landfill adjacent to the marsh area would be inundated by the 100-year storm and therefore would be considered to be located in the 100-year floodplain, however, the toe of the landfill would be protected against the 100-year flood elevation, as required by Virginia regulations so that no adverse effects to the landfill would occur during this rare event. Capping would be in compliance with applicable Virginia regulations and exceed the minimum requirement set forth in the Virginia sanitary and fill regulations.

Marsh Cap - The marsh cap would comply with the Virginia sanitary landfill regulations for the minimum thickness of the cap. The marsh cap would not attain all aspects of the Virginia sanitary landfill regulations (such as the specified maximum permeability of the cap materials), but these requirements are not applicable relevant or appropriate since one of the requirements of this cap is for it to act as a recharge area rather than preclude infiltration into the cap.

Option A - Option A will meet all relevant and appropriate regulations and federal and state law. Option A will enhance the protectiveness of the multilayer landfill cap.

Option B2 - Option B2 (shoreline protection along the streambank north of the marsh) would not provide required 100 foot offset from flowing water body; however, Option B2 will provide equivalent erosion protection measures and the 100 foot offset is not appropriate.

Option B3 - Option B3 (filling Gambo Creek and restoring as wetlands adjacent to waste south of the marsh) would comply with the 100 foot offset requirement from a flowing water body.

2.9.3 Cost-Effectiveness

The selected remedy is cost-effective because it would provide overall effectiveness proportional to the cost. Although more costly than several other alternatives, the selected alternative would achieve remediation goals more quickly and efficiently than other alternatives, provide greater long-term protection of human health and the environment and meet all identified ARARs.

2.9.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected alternative uses a permanent solution, capping. Capping is a permanent solution and is an appropriate remedy for landfill waste, soils, and sediments contaminated with SVOCs, metals, and pesticides. Capping is typical and appropriate for a site of this type.

2.9.5 Preference for Treatment as a Principal Element

The selected remedial action does not use treatment technologies because among other things, treatment is not practicable for a site of this size.

2.9.6 Documentation of Significant Changes

The selected remedy is the same alternative identified as the recommended alternative in the Proposed Remedial Action Plan and that was presented to the public at the public meeting held August 27, 1998.

There were no significant changes to the recommended remedial action alternative in the Proposed Plan.

It was determined, after issuance of the Proposed Remedial Acton Plan, that certain corrections were not incorporated, as intended, in the final Remedial Investigation document. An errata has been filed with the RI to detail these corrections. Consequentially, Table 2-2 of this Record of Decision now includes a fish tissue exposure point concentration for manganese; also, corresponding text has been corrected.

Provisions which address groundwater control requirements have been revised in order to better describe these requirements, not only as supplemental institutional controls, but also as remedial (corrective action) requirements which are needed to address site risk. Table 2-1 now contains groundwater COCs, and Section 2.4 (Summary of Site Characteristics) and Section 2.9 (Statutory Determinations) have been expanded.

Section 2.5.3 of the PRAP contains Remedial Action Objectives (RAOs) which were developed based on the Preliminary Remediation Goals (PRGs). RAOS may be modified during the Remedial Design based on more detailed evaluation. Some of the numerical values in the PRAP were transcribed incorrectly from the RI/FS documents. This ROD corrects this error.

3.0 RESPONSIVENESS SUMMARY

The selected remedy for Site 9 is a capping system. No written comments, concerns, or questions were received by the Navy, U.S. EPA, or the Commonwealth of Virginia during the public comment period from August 20, 1998 to September 18, 1998. A public meeting was held on August 27, 1998 to present the Proposed Plan for Site 9 and to answer any questions on the Proposed Plan and on the documents in the information repositories. A 30-minute presentation was provided during which informal questions were addressed. A period was set aside for formal questions to be recorded by the court reporter. No formal questions were asked during the meeting.

A summary of the informal questions that were asked at the public meeting is provided in Appendix B. Additionally, a copy of the certified transcript of the Public Meeting is attached in Appendix B.

3.1 BACKGROUND ON COMMUNITY INVOLVEMENT

The Navy and NSWCDL have had a comprehensive public involvement program for several years. Starting in 1993, a Technical Review Committee (TRC) met on average, twice a year to discuss issues related to investigative activities at NSWCDL. The TRC was comprised of mostly governmental personnel, however a few private citizens attended the meetings.

In early 1996, the Navy converted the TRC into a Restoration Advisory Broad (RAB) and 8 - 10 community representatives joined. The RAB is co-chaired by a community member and has held meetings approximately every four to six months. The Feasibility Study and the Proposed Plan for Site 9 were both discussed at the RAB meetings and a Site 9 tour was undertaken during a special RAB meeting.

Community relations activities for the final selected remedy include:

The documents concerning the investigation and analysis at Site 9, as well as a copy of the Proposed Plan were placed in the information repository at the NSWCDL General Library and the Smoot Memorial Library.

Newspaper announcements on the availability of the documents and the public comment period/meeting date was placed in The Journal on August 19, 1998 and the Freelance Star Newspaper on August 20, 1998.

The Navy established a 30-day public comment period starting August 20, 1998 and ending September 18, 1998 to present the Proposed Remedial Action Plan. No written comments were received during the 30-day public comment period.

A Public Meeting was held August 27, 1998 to answer any questions concerning the Site 9 Proposed Plan. Approximately 11 people, including federal, state and local government representatives attended the meeting.

APPENDIX A

COMMONWEALTH OF VIRGINIA CONCURRENCE WITH THE SELECTED REMEDY

APPENDIX B

SUMMARY OF INFORMAL COMMENTS

During the Public Meeting held on August 27, 1998, an overview of the Proposed Remedial Action Plan for Site 9 was presented during a 30-minute period. The Navy, the Commonwealth of Virginia, or the EPA have received no written comments from the public During the presentation informal comments were received from attendees. These comments included the following:

Summary of Comments Received during the Public Meeting

1. What is the difference between the landfill cap and the marsh cap?

   It was explained that the landfill cap would be designed to significantly reduce rainfall infiltration through the cap to the buried waste materials. The marsh cap would be designed to provide a physical barrier for plants and animals from coming in contact with contaminated surface sediment in the marsh area. The marsh cap would also be designed to prevent groundwater from potentially rising to the surface of the marsh and transporting contaminants to the surface of the marsh cap. The marsh cap would be designed to provide a sufficient elevation difference between the surface of the marsh cap and the level to which groundwater may naturally rise. The marsh cap soil would also be selected so that rainfall infiltration through the cap material would occur.

2. Why is a slurry wall preferred?

   It was explained that the slurry wall is an impermeable barrier that prevents groundwater upgradient of the landfill from passing through buried waste material. Instead, upgradient groundwater would be directed around the landfill to the north and south.

3. Where is the contaminated groundwater and why wouldn't it be used for drinking water?

   It was explained that groundwater generally moves from the west toward the east and ultimately enters Gambo Creek. The area of contaminated groundwater is therefore below the marsh between the landfill and Gambo Creek, which is generally considered to be an area that would not be developed because of the marsh conditions. Consequently, it is unlikely that anyone would ever want to use groundwater from below the marsh for drinking water. In addition, as part of the institutional controls, future use of groundwater would be prohibited.

4. Why is there such a large difference in costs between the alternatives?

   It was explained that the alternatives and options that involve excavation of marsh materials significantly increase costs.

NAVAL SEA SYSTEMS COMMAND

NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION

PUBLIC MEETING

THURSDAY, AUGUST 27, 1998, 7:00 P.M.
KING GEORGE COUNTY COURTHOUSE
KING GEORGE, VIRGINIA

PROPOSED REMEDIAL ACTION PLAN
Site 9, Disposal/Burn Area

USEPA Region III
Hazardous Site Cleanup Division
Federal, Facilities Section
Mr. Bruce Beach
1650 Arch Street, Philadelphia, Pennsylvania 18107

Virginia Department of Environmental Quality
Mr. David Gillispie
629 East Main Street, Richmond, Virginia 23219

Public Affairs Office
Commander, Naval Surface Warfare Center
Ms. Jennifer Wilkins
17320 Dahlgren Road, Mail Code CD06 Dahlgren, Virginia 22448

Reported by: Lola Gail Serrett

FRANCES K. HALEY & ASSOCIATES, Court Reporters
10500 Wakeman Drive, Suite 300, Fredericksburg, VA 22407
PHONE: (540)898-1527 FAX: (540)898-6154

August 27, 1998:

There were no formal questions on the floor at this meeting.

CERTIFICATE OF COURT REPORTER

I, Lola Gail Serrett, hereby certify that I was the Court Reporter at the Public Meeting held at King George Courthouse, King George, Virginia, on August 27, 1998, at the time of the meeting herein.

I, further certify that the foregoing transcript is a true and accurate record of the proceeding herein.

Given under my hand this 30th day of August, 1998.

<IMG SRC 98069I>

FRANCES K. HALEY ASSOCIATES, Court Reporters
10500 Wakeman Drive, Suite 300, Fredericksburg, VA 22407
PHONE: (540)898-1527 FAX: (540)898-6154

APPENDIX C

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ARAR or TBC	Regulation	Classification	Requirement Synopsis	Applicability to Remedial Alternatives
I. LOCATION SPECIFIC				
Endangered Species Act of 1978	16 USC º 1531 50 C.F.R. Part 402	Applicable	Act requires federal agencies to ensure that any action authorized by an agency is not likely to jeopardize the continued existence of any endangered or threatened species or adversely affect its critical habitat.	Potentially affected endangered species have not been identified. The remedial action will be implemented so resources are not adversely affected should any be identified in the future.
Virginia Endangered Species Regulations	4 VAC 15-20-130 to 140	Applicable	Similar Virginia requirements for submittal and review of environmental assessments.	
Regulations for the Enforcement of the Endangered Plant And Insect Specifies Act	2 VAC 5-310-10	Applicable		
The Archaeological and Historical Preservation Act of 1974	16 U.S.C º 469	Applicable	Requires actions to avoid potential loss or destruction of significant scientific, historical, or archaeological data.	Site is not known to be within a historically significant area. If future resources are identified actions will be taken to ensure compliance.
Virginia Natural Area Preserves Act	º 10.1-209 to 217	To Be Considered	Allows for preservation of certain significant ecological systems.	If specific species are found, actions will be taken to eliminate or minimize degradation to these resources.
Migratory Bird Area	16 USC º703	Applicable	Protects almost all species of native birds in the U.S. from unregulated "take" which can include poisoning at hazardous waste sites.	Remedy will be implemented to ensure that wastes have no impacts to native birds.

APPENDIX C

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
SITE 9 DISPOSAL BURN AREA
NSWCDL, DAHLGREN, VIRGINIA

ARAR or TBC	Regulation	Classification	Requirement Synopsis	Applicability to Remedial Alternatives
Chesapeake Bay Preservation Area Designation and Managerment Regulations	9 VAC 10-20-10 to 280	Relevant and Appropriate	Requires that certain locally designated tidal and non-tidal wetlands and other sensitive areas be subject to limitations regarding land-disturbing activities, removal of vegetation, use of impervious cover, erosion and sediment control, and stormwater management.	Remedy implementation will require construction activities. Actions will address the regulatory requirements.
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	40 C.F.R. 264.18 (b)	Applicable	Applies to treatment, storage, or disposal of hazardous waste within a 100 year floodplain area.	Remedy implementation may produce incidental hazardous wastes within the 100 year floodplain area, although none are expected. Hazardous wastes encountered will be managed consistent with Federal and Virginia requirements.
Virginia Hazardous Waste Management Regulations	9 VAC 20-60-10 to 1480	Applicable	Applies to treatment storage, or disposal of hazardous waste.	Hazardous wastes encountered will be managed consistent with Federal and Virginia requirements.
Virginia Water Protection Permit Regulation	9 VAC 25-210-10 to 260	Applicable	Facility or activity design must adequately address the issues arising from locating facilities in wetlands and delineated wellhead protection areas (determined vulnerable).	Remedy implementation will impact a wetland area. The remedy will minimize impacts to the wetlands and will restore wetlands areas on the facility.

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ARAR or TBC	Regulation	Classification	Requirement Synopsis	Applicability to Remedial Alternatives
Executive Order 11988, Protection of Floodplains	40 C.F.R. 6, Appendix A; excluding Sections 6(a)(2),6(a)(4). 6(a)(6); 40 C.F.R. 6.302	Applicable	Facilities or activities located within the floodplain must comply with this order.	Site is partially within Gambo Creek and is therefore partially in the 100 year floodplain. Remedy will be installed in the floodplain and will be designed and constructed to minimize impacts to floodplain resources.
Executive Order 11990, Protection of Wetlands	40 C.F.R. 6. Appendix A	Applicable	Action to minimize the destruction, loss, or degradation of wetlands.	Portions of the site is in Gambo Creek and are characterized as wetlands. Remedy implementation will be designed and constructed to mitigate wetland losses.
Clean Water Act of 1972 (CWA) Section 404	33 U.S.C. °°1344			
Virginia Wetlands Policy	4 VAC 25-380-10 to 40	Applicable		
Procedures for Implementing the Requirements of the Council on Environmental Quality on the National Environmental Policy Act	40 C.F.R. Part 6 Appendix A	Applicable	EPA's policy for carrying out the provisions of Executive Order 11990 (Protection of Wetlands). No activity that adversely affects a wetland shall be permitted.	Portions of the site are in Gambo Creek and are characterized as wetlands. Remedy implementation will be designed and constructed to mitigate wetland losses.

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ARAR or TBC	Regulation	Classification	Requirement Synopsis	Applicability to Remedial Alternatives
II. ACTION SPECFIC				
Capping /Closure and Post Closure for Municipal Solid Waste Landfills	40 CFR 258.60-61	Applicable	Requirements for final cover systems to minimize infiltration and erosion. Requirements for at least a 10 year post closure care period including maintaining integrity and effectiveness of the final cover. Maintenance of groundwater monitoring and landfill gas monitoring systems.	Installation of Virginia Sanitary Landfill Cap requires adherence to these regulations or equivalent performance standards at Site 9.
Virginia Solid Waste Management Regulations	9 VAC 20-80-10 to 790	Applicable		
Military Munitions Rules	(40 CFR 260-266 and 270)	To Be Considered	Recently promulgated regulations in response to Section 107 of the Federal Facilities Compliance Act of 1992 identifying when conventional and chemical military munitions become hazardous waste. Applications of the rules are a 'TBC' until adopted by states authorized to administer RCRA.	Ordinance-related wastes potentially buried at Site 9 will be managed in compliance with the rules.
DoD Guidance on Property Contaminated with Ammunition, Explosives or Chemical Agents	DoD 6055.9-STD	To Be Considered	Dod guidance document stipulating policy and procedure to provide protection of personnel resulting from DoD ammunition, explosives or chemical agent contamination. Includes property currently or formerly owned, leased or used by DoD, and calls for identification and control at active installations, and provides guidance for potential land disposal.	Capping of Site 9 will be completed to be consistent with DoD policy and procedures to address safety issues.

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Erosion and Sediment Control Regulations	4 VAC 50-30-10 to 110	Applicable	Erosion and sediment control plans are to be submitted for land-disturbing activities, and be in compliance with of the locality and/or local soil and water conservation district.	Construction activities will disturb the land in the vicinity of the site. Activities will address Virginia erosion and sediment control requirements.
Virginia Solid Waste Management Regulations	9 VAC 20-80-250 9 VAC 20-80-210 9 VAC 20-80-310	Applicable Applicable Applicable	Permanent Closure Criteria governing: Access Restriction, Closure and Post Closure Care, Gas Management, Drainage Layer, Final Cover, Run-on Run-off controls, Site Monitoring, Control of Groundwater Intrusion, Groundwater Corrective Action and compliance with other permanent closure requirements.	Virginia Solid Waste Management requirements need to be addressed with the installation of the cap at Site 9. Equivalent performance standards will meet Final Cover requirements.
AIR				
Gas Collection and Vents	CAA Section 101 42 U.S.C. º7401,and 40 C.F.R. 52	Relevant and Appropriate	File an Air Pollution Emission Notice (APEN) with the State to include estimation of emission rates for each pollutant expected. Design system to provide an odor-free operation.	Design of capped area anticipated to include venting to ensure cap functions as intended.
Gas Collection and Vents	40 C.F.R. 52	Relevant and Appropriate	Predict total emission of volatile organic compounds (VOCs) to demonstrate emissions do not exceed 450 lb/hr, 3,00 lb/day, 10 gal/day or allowable emission levels from similar sources using Reasonably Available Control Technology (RACT).	Design of capped area to demonstrate that decomposition gases address regulatory requirements.

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Gas Collection and Vents	40 C.F.R. 60 Subpart WWW and CC	Applicable	New Source Performance Standard (NSPS) for municipal landfills: Landfill Emission Rule; deals with non-methane organic compounds.	NSPS requirements include calculations for gas emission rates, limitations on non-methane emissions, monitoring and recordkeeping. Site 9 gas vent emissions are not expected to be significant.
Gas Collection and Vents	CAA Section 112(D) 42 U.S.C. º7412	Relevant and Appropriate	Emission Standards for new stationary sources.	NSPS for venting. Confirmation that standards are not exceeded will be addressed.
Gas Collection and Vents	CAA Section 118 42 U.S.C. º7418	Relevant and Appropriate	Control of air pollution from Federal Facilities.	NSWCDL is a Federal Facility and will address all CAA requirements.
Visible and Fugitive Dust Emissions	9 VAC 5-30-20	Applicable	Control of Particulate Matter (TSP)	Visible and Fugitive Dust emissions from remedial actions shall be controlled, as necessary.
	9 VAC 5-30-60	Applicable	Control of Particulate Matter (PM 10)	
	9 VAC 5-50-60 to 120	Applicable	Standards for visible and/or fugitive dust emissions.	
Standards of Performance for Toxic Pollutants	9 VAC 5-50-160 to 230	Applicable	Standards of performance for toxic pollutants.	Toxic pollutants are not expected during remedial actions; however, corrective action will be performed if problems arise.

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ARAR or TBC	Regulation	Classification	Requirement Synopsis	Applicability to Remedial Alternatives
WATER				
Criteria for Classification of Solid Waste Disposal Facilities and Practices	49 C.F.R. 257.3-3(a) 33 U.S.C. ºº1342	Potentially Applicable	A facility shall not cause a discharge of pollutants into the waters of the U. S. that is in violation of the substantive requirements of the NPDES under CWA Section 402, as amended.	No discharges under the remedy are planned. In addition, NPDES program is delegated to Virginia (VPDES). Potentially applicable for situations potentially not covered by VPDES.
Criteria for Classification of Solid Waste Disposal Facilities and Practices	49 C.F.R. 257.3-3(a) 33 U.S.C. ºº1288	Applicable	A facility or practice shall not cause nonpoint source pollution of the waters of the U. S. that violates applicable legal substantive requirements implementing an areawide or Statewide water quality management plan approved by the Administrator under CWA Section 208, as amended.	Potential future releases to groundwater could migrate to the stream. Ongoing monitoring will address the requirement.
Criteria for Classification of Solid Waste Disposal Facilities and Practices	49 C.F.R. 257.3-4 and Appendix 1	Applicable	A facility or practice shall not contaminate an underground drinking water source beyond the solid waste boundary or a court- or State-established alternative.	Potential future releases to groundwater could contaminate groundwater over risk-based criteria. Ongoing monitoring will address the requirement.
Clean Water Act	33 U.S.C. º1251 et seq.	Relevant and Appropriate	Criteria and standards for groundwater quality. Virginia regulation provides basis for risk-based remediation and discharge limitations.	Provides basis for risk-based decision making, establishes standards for groundwater quality. Ongoing monitoring at Site 9 will address the requirement.
Water Quality & Groundwater Standards	9 VAC 25-260-190 to 240	Relevant and Appropriate		

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Surface Water Standards	9 VAC 25-260-5 to 150, 160-170,310	Relevant and Appropriate	Standards and criteria for State waters, including wetlands.	Provides standards for evaluating State waters and wetlands at Site 9.
Virginia Pollution Discharge Elimination System (VPDES)	9 VAC 25-31-10 to 940	Applicable	Procedures and requirements for discharging pollutants into surface waters, or any activity which impacts physical, chemical or biological properties of surface waters.	Capping of Site 9 is not expected to produce waste liquids that would be discharged to surface waters. Any future activities or groundwater monitoring (e.g. generation of purge water) will address regulatory requirements.
Virginia Pollution Abatement (VPA) Permit Regulation	9 VAC 25-32-10 to 300	Applicable		
Virginia Solid Waste Management Regulations	9 VAC 20-80-250 (D)	Applicable	Groundwater Monitoring Design	completion of additional soil borings, monitoring wells and subsurface investigations will be consistent with regulatory requirements.
Stormwater Management Regulations	4 VAC 3-20-10 to 251	Applicable	Criteria for Stormwater Management.	Design of Site 9 cap will include applicable stormwater management requirements.

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